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AGNIHOTRA – A Non Conventional Solution to Air Pollution

Pushpendra K. Sharma*, S. Ayub@, C.N.Tripathi#, S. Ajnavi *, S. K. Dubey*
*Assistant Professor, Civil & Env. Engineering, HCST, Mathura. 281122, UP, India
@Associate Professor, Civil Engineering, AMU, Aligarh, 202001, UP, India
#Associate Professor, Civil & Env. Engineering, HCST, Mathura. 281122, UP, India
Email: sohailayub@rediffmail.com

Abstract - **The present study entitled "Agnihotra-A Non conventional solution to air pollution" is completely based on laboratory work. Our main aim was to find out non conventional solution to air pollution by criteria pollutants like SOx, NOx, CO, RSPM, and SPM. We used very innovative ideas to reduce the concentration of criteria pollutants using Agnihotra. In this experimental work we have achieved a good level of treatment. We conducted yagya, using all the procedure guided by literature of Pandit Shri Ram Sharma Acharya, in laboratory and artificially generated pollution conditions. After taking 5-10 readings and studying all the different methodologies, using almost 324 Ahuties yagya with clarified cow butter (ghee), Pipal wood (Ficus religiosa), Havan samagri (kapurkachari, gugal, nagarmotha, balchhaar or jatamansi, narkachura, sugandhbela, illayachi, jayphal, cloves and dalchini etc.), we came across a conclusion that the air pollution of criteria pollutants can be effectively reduced opting column method using locally available materials and without adding any chemicals. Under the natural lab conditions and after creating local and artificial indoor air pollution it was noticed that Sox, Nox were considerably reduced by almost 51%, 60%respectively more by yagya when compared without yagya and both RSPM & SPM were also found to be reduced by 9% & 65% respectively more as compared to the condition without yagya. Although the RSPM & SPM concentrations were still there but not to the extent of unhygienic conditions. The odor and smell of the Havan hall was not at all objectionable.**

Key words: Yagya, Agnihotra, Acharya, Havan Samagri, Pandit, Aahuty. RSPM, SPM.

I. Introduction

Atmospheric pollution is considered to be most dangerous pollutant of our ecosystem as it has direct influence over all living and nonliving things and its control by isolation and then cleaning becomes beyond man's effort unless the pollutants are controlled at the source itself. A diverse variety of pollutants are emitted into the atmosphere by both natural, anthropogenic and industrial activities sources.

Today we are bound to breathe in harmful gases like NO2, CO, SPM and RSPM, which are all beyond the limits prescribed by the various Environmental Agencies and are extremely harmful for human health. The Government is spending billions of Rupees to tackle such problems but not very effectively positive results are being seen.So an effective, long lasting and non-conventional solution for this air pollution problem, the Vedic Science of 'Yagya' was chosen for the necessary experimentation to see if it actually helped in the reduction of air pollution as mentioned in the ancient books. By burning several types of wood and as per digital analog records of Co emission, the mango wood was found with almost near zero CO emission and that's why its Samidhas were used for the experiment. The special Havan Samigri prescribed by Brahma Varchas, for the purification of atmosphere, was used along with the normal havan samigri and Cow's pure ghee for the Havan.

In all the experiments, the effect of Yagya was studied on the atmospheric odour, on the air microflora and also on the gaseous pollutants like NO2, SO2 and RSPM. The effect of odour was very good as after Yagya, the nice smelling odor lingered on till the evening and a very faint smell remained till the next day (in the indoor experiments).

To study the impact of Yagya on air microflora, several indoor experiments were conducted, to compare the effect of Yagya and that of non-Yagya. The results were very encouraging. In all the indoor experiments there was a significant reduction in the microbes especially the pathogens . The decrease on the day 3 in the four experiments has been recorded as 100%, 67%, 87% and 93% respectively in pathogens, which is impressive and supportive of the fact

that Yagya renders the atmosphere bacteriostatic and it kills the harmful microbes in the atmosphere. (Central Pollution Control Board, Delhi.)

One experiment was continued till 7 days after Yagya resulting an impressive reduction of 93%, in bacteria, 88% in fungi and 93% in pathogen, as compared to their respective backgrounds showing the effect of Yagya is long lasting and it continues till long after the physical process has ocuured. It is the general belief that any type of fumes help in the reduction of air microbes. In the experiments of comparison of Yagya with that of non- Yagya, proper Yagya was performed at one place and plain wood was burnt at another place keeping factors like temperature, humidity, number of persons, air flow etc., as constant and samples of air were taken before Yagya, during Yagya and till two days after Yagya. The results were very surprising. In the case of Yagya where there was a reduction of 79%, 68% , 69% and 33 % respectively as compared to the background in the bacteria, fungi, TMF and the pathogens till two days after the Yagya there was an increase of 111%, 257%, 104% and 100% respectively as compared to the background, one day after the Non-Yagya experiment. The same experiment was repeated again after one year and the results of this experiment were again similar. In fact the fumigation of simple wood has led to an increase in the counts in most of the cases. Whereas on the other hand the smoke/ gases produced as a result of Yagya led to an overall decrease in the Air microflora in the atmosphere.

Another study was conducted in the open air at a place called Karawal Nagar in East Delhi where a large scale Yagya of 108 Kunds was performed. The sampling was done in the same way as in the case of indoor experiments and a comparison of the microbe colony counts during and after Yagya was made with the background . The experiment continued from 12th to 16th of Yagya and the sampling was continued till two days after the Yagya. The results show that in comparison with the background counts, there was a reduction of 55% in bacteria, 15% in fungi, and 79% in the pathogens on the next day after the Yagya was over. The reduction in pathogens was 79% even on the second day after Yagya. The total micro flora had reduced by 49% on the 2nd day after Yagya. (Experiments conducted under Central Pollution Control Board, Delhi.)

In order to study the effect of Yagya on the gaseous pollutants, two experiments were performed in the open air. Samples of air were collected by CPCB in one case and by Envirotech in the second case and analyzed for gaseous pollutants SO2 and NO2 . The two experiments were performed at M.S.Apartments, K.G. Marg, New Delhi, in the open air in January 2004 and February 2005, respectively. In both the experiments the objective was to see if there was any effect of performing Yagya in the open air on the gaseous pollutants. The results in both the cases were encouraging. In the first experiment there was a reduction of 47% in NO2 on the day of Yagya and 60% on the next day. In case of SO2, the reduction was 86% on the day of experiment and almost 100% on the next day as the SO2 was below detection level.

Similarly in the second open air experiment the NO2 reduced by23% on the day of experiment and was25% reduced on the next day after Yagya. SO2 was 33% below the background level on the day of Yagya and was 41% reduced on the 2nd day after Yagya. In both the above experiments there has been perceptible change in the quantum of NO2 and SO2, as compared to the background. (Experiments conducted under Central Pollution Control Board, Delhi.)

All the above findings are indicative of the fact that the process of Yagya is effective in the reduction of air pollution both gaseous and microbial and also removes the bad odour, if any, at the place. It is also seen that the effect of Yagya remains in the atmosphere for days after it has actually been performed. Hence we see that ‘Yagya’ is probably the only possible solution for today’s environmental pollution problems.

The importance of this Yagya was known to our ancestors who recommended that Yagya should be performed by every person and in every home on daily basis. Today we have forgotten this science and it is time that we should revive this ritual and adopt it for the betterment of ourselves and our future generations. (Agnihotraindia.com)

A. Air Pollution

Air pollution includes a diverse array of natural and anthropogenic emissions, gaseous constituents, volatile chemicals, aerosols and their atmospheric reaction products. Ambient air is an atmospheric sink, where all above emissions are released. Many such emissions in small quantities get immediately dissipated and absorbed but continuous release of these pollutants pose hazards to human health. Despite many pollution control efforts, the air quality is going deteriorated to alarming levels in several cities throughout the world. The World Health Organization (WHO) estimates that as many as 1.4 billion urban residents in the world breathe air exceeding the WHO air quality guidelines (World Resource Institute, 2000). The health consequences of exposure to dirty air are considerable. On a global basis, estimates of mortality due to outdoor air pollution is estimated to be around 2.0 to 5.7 lacs, representing about 0.4 to 1.1 percent of total annual deaths. The severe adverse effects of air pollution are more pronounced in the

developing countries like India. On the one hand, the developing countries are grappling with the environmental problems associated with inadequate economic developments, the hallmarks of which are malnutrition, poor sanitation and lack of basic human needs. On the other hand, in their pursuit for rapid economic development, the developing countries are confronted with a newer set of environmental problems due to increasing air pollution on account of industrialization, urbanization and motorization.

Severe air pollution episodes during last century have shown that breathing dirty air can be dangerous and at times deadly. The 1948 'Killer Fog' in small town of Donora, Pennsylvania that killed 50 and the particularly virulent 'London Fog' of 1952, in which some 4000 died, were associated with widespread use of dirty polluting fuels. Since then, many countries have adopted ambient air quality standards to safeguard the public against the most common and damaging pollutants, which include sulphur dioxide, suspended particulate matter, ground level ozone, nitrogen dioxide, carbon monoxide and lead, which are directly or indirectly released by the combustion of fossil fuels. Although substantial investments in pollution control in some countries have lowered the levels of these pollutants in many cities, poor air quality is still a major concern throughout the industrialized world.

B. Indoor Air Pollution

Combustion, building material, the ground under the building and biological agents are the four major principal sources of indoor air pollutants. Indoor air pollutants can pose even a greater health risk and hence is a concern where energy efficiency improvements sometimes make the house relatively air tight thereby reducing ventilation and raising indoor pollutant levels. Indoor air pollution is usually associated with occupational situation particularly through combustion of biomass fuels. Traditional fuels for cooking and heating produces large amounts of smoke and other air pollutants in the confined space of home, a perfect recipe for high exposures. Liquid and gaseous fuels such as kerosene and bottled gas although not completely pollution free but many times less polluting than unprocessed solid fuels. In these circumstances, exposure to pollutants is often far higher indoors than outdoors.

The health problems due to indoor air pollutants are more widespread than those caused by outdoor air pollutants for the following reasons.

- The exposed persons are in close proximity to the source of indoor air pollutants.
- A recent report of WHO asserts 'the rule of 1000' which states that a pollutant released indoor is one thousand times more likely to reach the lungs than a pollutant released outdoors.
- Women and children, particularly those in rural sector spend more time indoors than outdoors.
- In rural areas, indoor air pollution is responsible for much greater mortality than ambient air pollution.

Epidemiological studies have linked exposure to indoor air pollution from dirty fuels with at least four major categories of illness:

- Acute respiratory infections (ARI) in children
- Chronic Obstructive Pulmonary Disease (COPD) such as asthma and bronchitis;
- Lung cancer and
- Pregnancy related problems. Of these, ARI appears to have the greatest health impact in terms of the number of people affected.

Almost 80% of domestic energy consumption in our country is traditional biomass fuels When these fuels burn in simple cook stoves during meal preparation, air inside homes get heavily polluted with smoke that contains large amounts of toxic pollutants such as carbon monoxide, oxides of nitrogen (NOx), sulphur dioxide (SO2), aldehydes, dioxins, polycyclic aromatic hydrocarbons and respirable particulate matter. The resulting human exposures exceed the permissible norms.

II. Key Findings of Indoor Air Pollution Studies (ESMAP, World Bank 2000)

Exposure to biomass smoke increases the risk of acute respiratory infection (chest infection, coughs, colds and middle ear infections). Children in the Gambia Island found riding on their mother's back, during cooking over smoky stoves were more likely to develop Acute Respiratory Infection (ARI) then unexposed children.

A study in Tanzania reported that the children below five years age died of ARI, were more likely to sleep in a room with an open cook stove than healthy children in the same age group.

Studies in India and Nepal show those non-smoking women who have cooked on biomass stoves exhibit a higher prevalence of chronic lung disease (asthma and chronic bronchitis). The incidence of moderate and severe ailments among two year olds, increased as they spent greater hours near the fire.

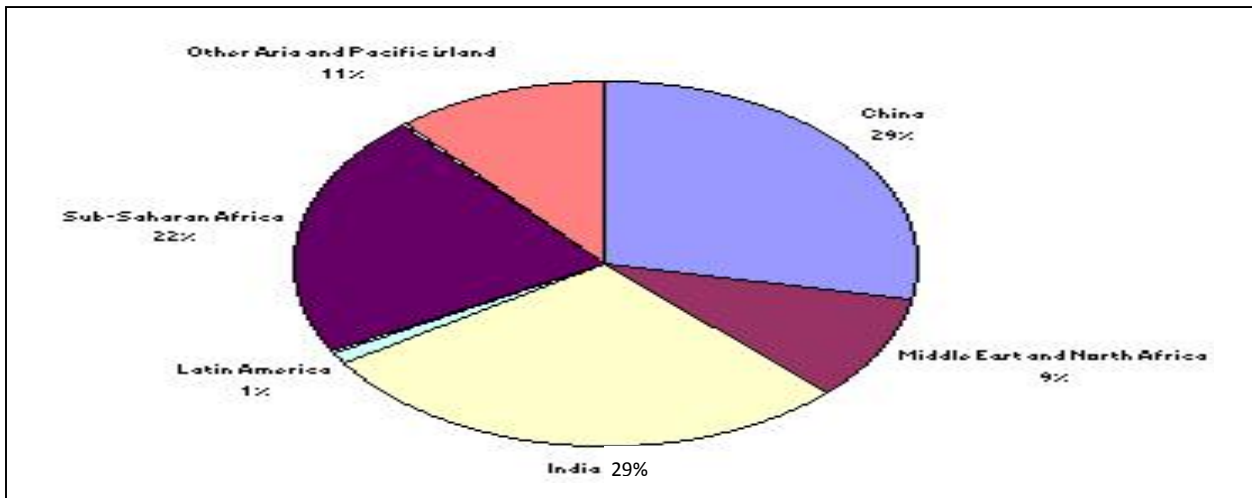
Exposure to high indoor smoke levels is associated with pregnancy related problems such as still births and low birth weights. One study in Western India found a 50% increase in stillbirths in women exposed to indoor smoke during pregnancy. Considerable amount of carbon monoxide has been detected in the blood stream of women cooking with biomass.

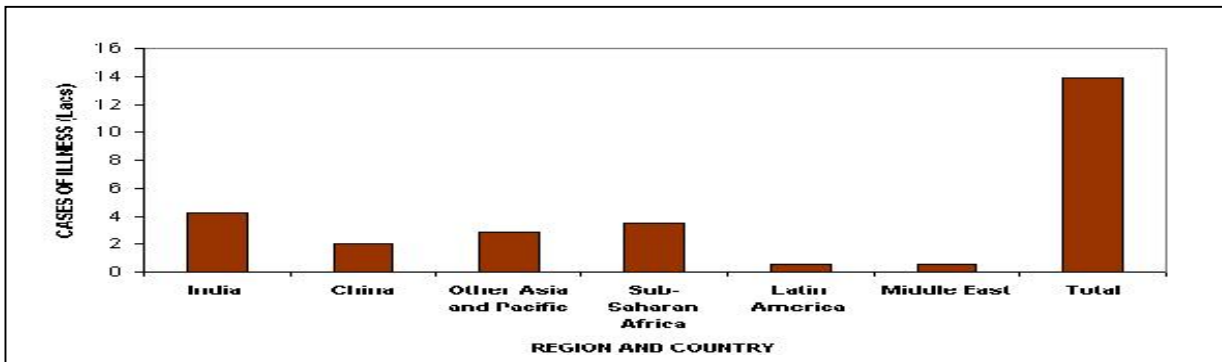
- Other than these four major categories of illness; indoor air pollution is associated with blindness and changes in the immune system. Eighteen percent of blindness may be attributed to the use of biomass fuels.

Further, a 1995 study in Eastern India found the immune system of new born to be depressed due to the presence of indoor air pollution.

1. Annual deaths due to Air Pollution in Urban and Rural areas

Region	*Urban Outdoors*	*Urban Indoors*	*Rural Indoors*	*Total*
Developed Countries	*14 (0.5)*	*252 (8.4)*	*28 (0.9)*	*294 (9.8)*
Developing Countries	*186 (6.2)*	*644 (21.5)*	*1876 (62.5)*	*2706 (90.2)*
Total	*200 (6.7)*	*896 (29.9)*	*1904 (63.5)*	*3000 (100)*

Source: Report of the Committee on Environment and Health (MoEF), May 2000

- Figure **1** Deaths due to Indoor Air Pollution in the Developing World

Source: *Indoor Air Quality, ESMAP, World Bank, September 2000*

Source: *Indoor Air Quality, ESMAP, World Bank, 2000*

Six Common Air Pollutants

The Air Prevention and Control of Pollution Act, 1981 requires MoEF to set National Ambient Air Quality Standards for six common air pollutants known as "criteria pollutants" found all across the country. These are

particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides and lead which can harm our health and the environment, and cause property damage. Of the six pollutants, particle pollution and ground-level ozone are the most widespread health threats. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards.

Table-2. Summary of Health Effects of Basic Air Pollutants:

Pollutant	Health Effects
Carbon Monoxide	Poor reflexes, Ringing in the ears, Headache, Dizziness, Nausea, Breathing Difficulties, Drowsiness, Reduced work capacity, Comatose state (can lead to death)
Lead (Pb)	Kidney Damage, Reproductive system damage, Nervous system damage (including brain dysfunction and altered neurophysical behaviours)
Oxides of Nitrogen (NOX)	Increased risk of viral infections, Lung irritation (including pulmonary fibrosis and emphysema), Higher respiratory illness rates, Airway resistance, Chest tightness and discomfort, Eye burning, Headache
Ozone (O3)	Respiratory system damage (lung damage from free radicals), Reduces mental activity, Damage to cell lining (especially in nasal passage), Reduces effectiveness of the immune system, Headache, Eye irritation, Chest discomfort, Breathing difficulties, Chronic lung diseases (including asthma and emphysema), Nausea
Sulphur dioxide (SO2)	Aggravates heart and lung diseases, Increases the risk for respiratory illness (including chronic bronchitis, asthma, pulmonary emphysema), Cancer (may not show for decades after exposure)
Respirable Particulate Matter (PM10)	Respiratory illness (including chronic bronchitis, increased asthma attacks, pulmonary emphysema), Aggravates heart disease

Source (central pollution control board Delhi)

Indian Sub-Continental scenario of Air Pollution

Air pollution in India is caused by similar sources as that of China like urban growth, auto emissions, etc., with the exception that coal fired power plants contribute a smaller percentage of air pollution. In contrast to China, it has been researched that the burning of biofuels, such as wood, agricultural waste, and dried animal manure in cooking stoves, is the largest source of black carbon emissions in India contributing almost 42% of the total (Venkataraman, et al., 2005).

It is common to see dense haze in northern India and Bangladesh during the winter. The haze lingers near the base of the mountains because of temperature inversions. During the winter cold air flows down the mountains to the plains making the air near the ground cooler than the air above it. This traps pollution from agricultural fires and cities near the ground. (February 3, 2006, MODIS/Terra image courtesy of NASA)

Selected Location of Agnihotra:

Hindustan College Of science and Technology, NH-2, Farah, Mathura U.P., India, which is situated at a distance of 28 km from Mathura.

III. MATERIALS AND METHODS

Agnihotra: A brief introduction

Gayatri and Yagya are the pillers of Indian philosophy and culture. Gayatri Mantra, the eternal source of universal knowledge is deciphered and the cosmic energy of sound contained in is activated and expanded with the help of Yagya.

The four Vedas reveal the philosophy of the eternity and absolute complementary role of Gayatri and Yagya in the divine creation. Atharvaveda deals with sound therapy aspects of mantras for the treatment of the ailing human system at the physical, psychological and spiritual levels. The Samaveda focuses on the musical chanting patterns of the mantras and the subtle form of Yagya by defining the latter as the process of mental oblation on the surface of internal emotions through the cosmic radiation of the omnipresent subtle energy of sound. The Yajurveda emphasizes the knowledge of principles and methods of performing Yagya as Spiritual and Scientific experiments for global welfare.

As a matter of fact Yagya is the selfless sacrifice for noble purposes. Sacrificing of the ego, selfishness and material attachments and adopting rational thinking, humane compassion and dedicated creativity for the welfare of all is indeed the best Yagya which should be performed by all human beings. The philosophy of Yagya teaches an art of living in the society in harmony, a living style to promote and protect higher human values in the society which is actually the basis of the ideal human culture.
The seva yagya, the service of the society is a noble example of Yagya. The Gnana Yagya, shows the service of people by enlightening their lives in the glow of knowledge and education. The Prana Yagya reveals the service of saving the lives of people from suffering and agonies and inspiring liveliness and respect for life in them. A variety of such Yagya are described in the Shastras. In physical terms, Yagya is a process aimed at the refinement of the subtle energy existing in matter with the help of thermal energy of the mantras. The knowledge of philosophy and science of Yagya is as essential for understanding and experimenting the science of spirituality as the knowledge of elementary physics is for material based sciences. The experiments of Yagya, when performed at a small scale in day to day life are called Havan or Agnihotra.

Scientific Aspects

There are two basic energy systems in the physical world: Heat and Sound. In performing Yagna, these two energies, namely, the heat from Yagna's fire and the sound of the Gayatri and other Mantras, are combined to achieve the desired physical, psychological and spiritual benefits. The fumigation of specific substances in the Yagna --- fire is a scientific method of subtulisation of matter into energy and expanding its potential and positive effects in the surrounding atmosphere. The electromagnetic waves generated thereby help in transmitting, at cosmic level, the desired sonic signals 'stored' in the Mantras, which are chanted during the process of sacrificing the special materials in the fire.

The various fumigating substances offered in Yagya are:

Wood:
Wood has to be small sticks of varying lengths called Samidhas according to the size of Agnikunda, dry and free from dust, insects and worms. The principal types of wood used are as, Sandal-wood (Santalum Album), Agar and Tagar wood (Aquilana Malaccensis and Valeriana Wallchii), Deodar (Cedrys Libani), Mango (Mangifera Indica), Dhak or Palash (Butea Frondosa), Bilva (Aegle Marmelos), Pipal (Ficus Religiosa), Bargad (Ficus Bengalensis), Shami (Proposis Spicigera), Gular (Ficus Glomerata). In addition to wood, various Havishya or Havan samagri are offered in Yagya can be divided into the following four groups of substances like,
Odoriferous: saffron, musk, agar, tagar, chandan, illaychi, jayphal, javitri and camphor.
Health Constituents: clarified butter (ghee), milk, fruits and cereals like wheat, rice, barley, til, kangu, munga, chana, arhar, masur or peas.
Sweet: sugar, dried grapes, honey or chhuhara.
Medicinal Herbs: Somalata or Giloya, Brahmi, Shankhpushpi, Nagkesar, Mulhati, Red Chandan, Baheda, Sonth and Harad. Now-a-days Havan samagri is readily available in the market consisting of the following substances in a crude powder form. Saw dust of sandal-wood and pine wood, the agar and tagar wood chips, kapurkachari, gugal, nagarmotha, balchhaar or jatamansi, narkachura, sugandhbala, illayachi, jayphal, cloves and dalchini.

Combustion products:

It is very difficult to interpret the process of combustion in a Yagya in a physical scientific terms due to: varying properties of substances used, unspecified conditions of combustion i.e. products of combustion depend on the following factors like nature of substances used and their proportions, temperature attained, air supply control and interaction amongst the various products formed etc.

Vaporization of wood:

Besides complete combustion of cellulose of wood, it is also subjected to vaporization. This occur due to the Samidhas arranged in the Agnikunda, the conditions of temperature and air supply which prevail in it.

Odorous Substances Steam Volatilization

The temperature in Agnihotra varies in the range 250°C - 600°C, while in actual flames it can go as high as 1200°C to 1300°C. The boiling points of volatile constituents get diffused over in the surrounding atmosphere. Also when cellulose and other carbohydrates undergo combustion, steam is formed in copious quantities by the combination of hydrogen of organic substances with the oxygen.This is how the substances like thymol, eugenol, pinene, terpinol etc., are spread in the surroundings and the aroma of a Yagya is smelt even at considerable distances.

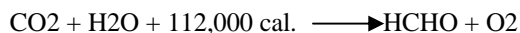
Along with steam, smoke is also given out in large quantities and solid particles existing in a highly divided state offer sufficient surface for mechanical diffusion. Thus smoke also functions as colloidal particles for diffusion of volatile aromatic substances depending on temperature and direction of the wind.

Fatty Substances Combustion:

The fatty substances used in Yagya are mainly ghee and other of vegetable origin. Ghee helps in rapid combustion of cellulose of wood and keeps the fire alight. All fatty substances used are combinations of fatty acids, which volatilise easily. The combustion of glycerol portion gives acetone bodies, pyruvic aldehyde and glyoxal etc. The hydrocarbons produced in the reactions again undergo slow combustion and as a result methyl and ethyl alcohols, formaldehyde, acetaldehyde, formic acid and acetic acids are resulted.

Photo-Chemical reaction

All the volatile substances diffused in the surrounding atmosphere undergo the photochemical reactions in the sunlight that is why it is recommended that Yagya to be performed in the presence of sunlight. These changes occur in the ultra-violet and other short wavelength regions. The products of fumigation thus go photochemical decomposition, oxidation and reduction. To some extent even CO_2 is also reduced to formaldehyde as follows:

$$CO_2 + H_2O + 112{,}000 \text{ cal.} \longrightarrow HCHO + O_2$$

From environmental angle, reduction of CO_2 produced in Yagya as above and liberation of oxygen cannot be overemphasized.

Inverted Pyramid Shaped Agni Kunda:

The word ‘pyramid’ means the fire in the middle’. The inverted pyramid shape of the Havan Kund allows controlled generation and multidirectional dissipation of energy. It acts as a generator of unusual energy fields and spreads them in its surrounding atmosphere.

For a daily Agnihotra (Balivaishva) a small copper pot is used. The inverted pyramid shaped Agnihotra pot receives , generates and decentralizes electrosphere. It acts as an effective bacteriostatic and antimicrobial reactor. Copper is universally acknowledged for its excellent conduction of electricity and heat.

The Agnihotra has an obvious link with fire, heat, electro-magnetic force and because of its inverted pyramid shaped Kunda, it does have connection with the cosmic energy fields. The dimensions of the copper pot used for the daily Agnihotras are: 14.5 cm×14.5cm at the top. 5.25cm×5.25 cm at the bottom and 6.5 cm in height with three steps. For large scale Yagyas, the dimensions are increased proportionately and the Kundas are also made up of specific combinations of clays. A part from the pyramid shape, some other special symmetric geometrical designs are also used according to the kind of energy fields and the cosmic currents required to be generated by the Yagya. Specific types of Kundas are recommended for different kinds of Yagyas.

Chanting Sanskrit Mantras:

The power of sound vibrations penetrates the energy spheres at the subtle and cosmic levels. All the alphabets of the Sanskrit language are endowed with special vibrational powers, which set out harmonious wave patterns when pronounced up to the mark. Dr. Howard Steingull, an American Scientist has established that recitation of Gayatri Mantra produces 110,000 sound waves per second. In fact recitation of the Gayatri Mantra during the fireworship (Yagya) acts supplimentary. The patterns of chanting of Mantras are so designed that they latently contain the essence of the music or the quite essential sound of the torrent of life sustaining energies emanating from the cosmic energy centre of the corresponding Mantras. Uttering of these Mantras produce vibrations soothing to human mind, all plant and animal life. These vibrations also spread specific energy waves in the surrounding atmosphere as the oblations are offered.

Environmental Purification by Agnihotra

The ecological imbalance caused by the industrial wastes, rapid urbanization, deforestation, air and water pollution, ozone layer depletion, radioactive waves etc., acts of 'civilized men' have resulted into disastrous threat not only to human survival but to the life as a whole on our planet. Till recently it was accepted that research into science can furnish answer to all of man's problems. Today we find increasing number of diseases including malfunctioning of body organs due to increasing severity of pollution in the atmosphere. Ozone layer depletion has been causing ailments like sunburn, skin cancer, cataracts and weakening of the immune system. Viruses are becoming drug-resistant and showing consistent growth trends.

Experimental studies reveal that the incidence of physical ailments, sickness and disease are reduced in the houses, where the Agnihotra is regularly performed because it creates a pure, nutritional and medicinal atmosphere. It renews the brain cells, revitalizes the skin, purifies blood and prevents growth of pathogenic organisms. Agnihotra is basically a healing process. 'Heal the atmosphere and the healed atmosphere will heal you' is the Modus Operandi . Purification of environment through the constituent electrons of the substances fumigated in the Yagya is an well proved effect of this process .

Dr. Hafkine mentioned "mixing ghee and sugar and burning them creates smoke which kills the germs of certain diseases and secretion takes place from some glands relate to the wind-pipe, which fill our heart and mind with pleasure".

"Sugars present in Havishya have great power to purify the atmosphere. It kills the germs of T.B., measles, smallpox and cow-pox remarks" Prof. Tilward.
According to Dr. Shirowich,
(i) Cow's milk contains great power of protection from atomic radiation;
(ii) Houses having cow-dung covered floors enjoy complete protection from atomic radiation;
(iii) If cow's ghee is put into Yagya fire, its fumes reduce the effect of atomic radiation to a great extent.

The medicinal fumes emanating from Agnihotra have been observed by researchers in the field of microbiology to be clearly bacteriolethal in nature. These eradicate bacteria and other micro-organisms, which are the root cause of illness and diseases. This must be the reason why the incidence of physical ailments, sickness and diseases becomes less in the households, where Agnihotra is regularly performed.

Even without going into detailed chemical bacteriology, it can be stated that performance of Yagya leads to purification of air. This takes place in the following four ways [2]:

Foul Odor Removal:

As already stated, under steam volatilization, the various volatile oils get diffused in the surrounding atmosphere along with steam and smoke. Since these oils have distinct good smell, the foul odors are automatically replaced. This aroma can be experienced easily in the surroundings when Yagna is performed due to diffusion of substances like thymol, eugenol, pine, terpinol and oils of sandal-wood, camphor and clove.

Bacterial Removal:

As stated under products of combustion, the partial oxidation of hydrocarbons and decomposition of complex organic substances produce formal dehyde which is a powerful antiseptic. It is also interesting to note that germicidal action of formaldehyde is only effective in the presence of water vapour which is also produced in large quantities in Yagna. The use of formaldehyde spray for disinfecting of walls, ceiling etc., is common and such a spray is automatically produced when Yagna is performed. The oxidation of hydrocarbons also produces formic acid and acetic acid both of which are good disinfectants. Use of formic acid for preservation of fruits and that of acetic acid in preserving vinegar is a common practice. The antiseptic and antibiotic effects of fumes of Yagna have also been examined by conducting suitable experiments on rabbits and mice and it has been established that fumes emitted in Yagna are powerful antibiotic. Agnihotra ash purifies and cleanses the water making it fit for drinking [5].

Insects Removal:

There are non-bacterial parasites like flies, ringworm, dice, fleas etc., which are immune to bactericides, which are also harmful to other living beings. Such insects which are generally immune to ordinary reagents. However they either get killed or are driven away, when they come in contact with the fumes of volatile oils like camphor diffused in the environment.

Agnihotra Farming:

The disinfection of air is not only useful to animal life but also helps plant's life though the bacteria responsible for diseases in both may be different. The aromatic substances during Yagna get diffused in the air and offer protection to plant life against harmful organisms. This ensures healthy plant growth. Agnihotra's atmosphere and ash can be used as adjuvants in the 'Natural farming' methods --- also known as the Agnihotra farming methods.

It is a holistic concept of growing plants in healthy atmosphere and maintaining ecological balance by performing Agnihotra (Yagna) in the middle of the farm and using the Yagna - ash as a fertilizer. It is not only safe and productive but also holistic in its approach towards environment.

CO2 generation in Agnihotra:

Consignment of the wood and other organic maters to flames has been always controversial because of generation of CO and CO2 and increase in consequent 'green house' effect. It had been argued that performance of Yagna also produces CO and CO2. It should be noted here that the way in which the Samidhas and Havishya are burnt in Yagna is a process of slow combustion at higher temperature. While the burning of coal in factories or in the household fire involves rapid combustion. where oxygen is sucked in large quantities and enormous CO2 is emitted. In the slow combustion taking place in the process of Yagna, small quantity of O2 is utilised meager CO2 is emitted that poses no threat to the environment. In fact whatever CO2 is generated it is readily absorbed by the surrounding vegetation and CO2 cycle is strengthened . The other important aspect is the fact that CO2 produced in Yagna is not always free CO2 but it remains mixed with other aromatic oils and antiseptic products. It therefore, acts as a vehicle in transporting such products to distant surroundings.

The use of CO2 as a cerebral stimulant to assist the patients suffering from lack of ventilation is common in medical world. Its use to control and cure many mental disorders is also known to medical science. Small amounts of CO2 inhaled by the persons performing Yagna acts as a stimulant and more and more aromatic fumes are inhaled which help in curing mental disorders. Particularly effective results with respect to the elimination or reduction in radiation were achieved through Yagna's fire and ash. These observations are made by Dr. L. Maela Anatoninhowska of Poland after using P.S.I. techniques.

IV. METHODOLOGY

The entire process can be divided in following two parts:

Air sampling

- Initial condition
- After generating pollution
- After performing yagya

Generated pollution:- pollution generated by burning of following materials.

Table no.3 Quantity of the materials used for generating local and artificial pollution.

S. No.	Material	Quantity in Kg
1	Wooden powder(burada)	0.345
2	Wood coal	0.940
3	Hard coal	0.990
4	Tyre	0.440
5	Poly bags	0.400
6	Cow dung cakes	1.700
7	Mixture of (sodium potassium)	0.090

Yagya procedure details

The entire process of yagya was done under the supervision of Tapo Bhoomi Mathura, Gayatri Pariwar and the materials used were: Pipal wood (Ficus religiosa) , Clarified butter (ghee), Sweet Substances: sugar, dried grapes, Havishya:- Somalata or Giloya, Brahmi, Shankhpushpi, Nagkesar, Mulhati, Red Chandan, Baheda, Sonth and Harad kapurkachari, gugal, nagarmotha, balchhaar or jatamansi, narkachura sugandhbala, illayachi, jayphal, cloves and dalchini, A

Artificial indoor air pollution

Agnihotra

Sampling of air pollutants

For SOx analysis TCM solution is used as absorbent

Absorbing solution:- Sox from air is absorbed in a solution of potassium tetra chloromercurate (TCM) Formation dissolve 10.86gm mercuric chloride in 1 liter of volumetric flask, add 0.066 gm EDTA, add6.0 gm potassium chloride / sodium chloride [4.68gm] make up to one liter volume. The pH of this reagent is 4-5.

For NOx analysis NaOH solution is used as absorbent Absorbing solution 1gm NaOH and 0.25gm Sodium Arsenite In 250 ml solution.

OBSERVATIONS:

phs o

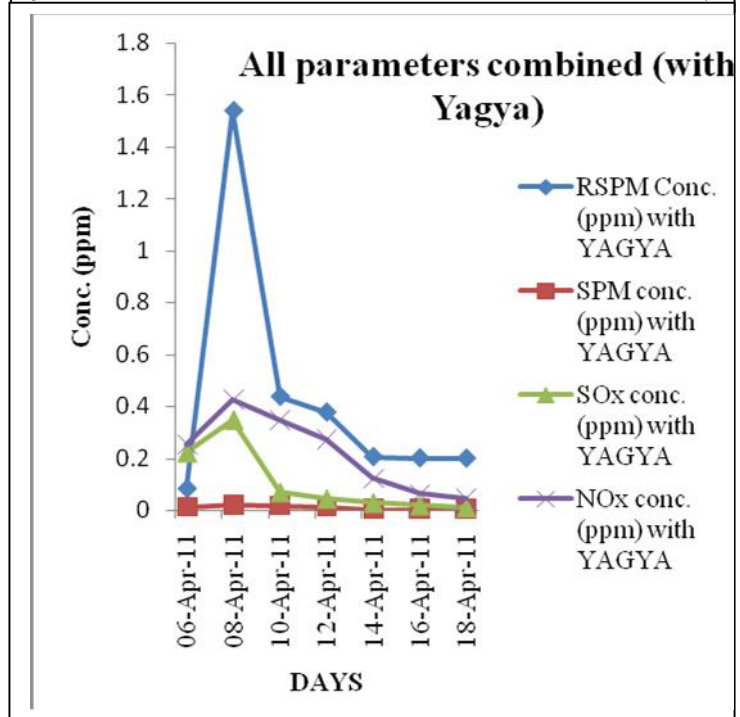
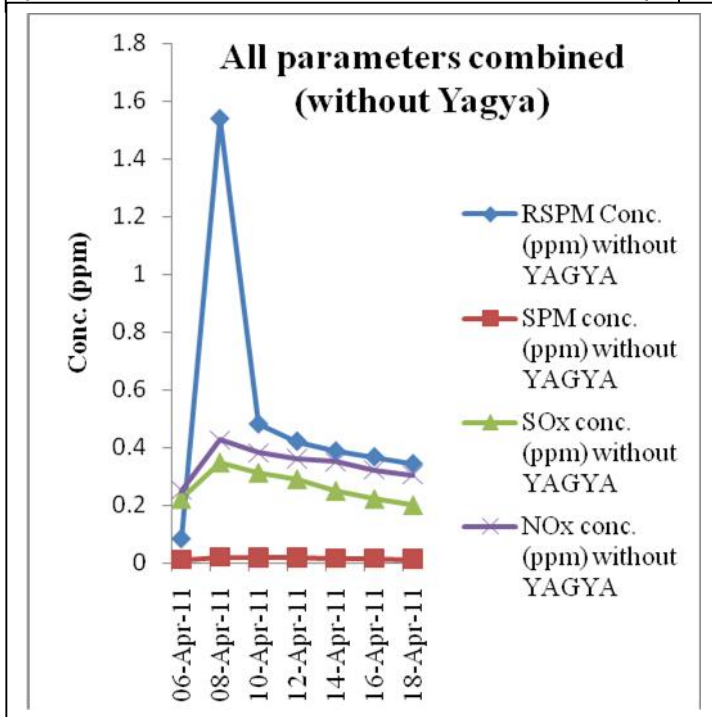
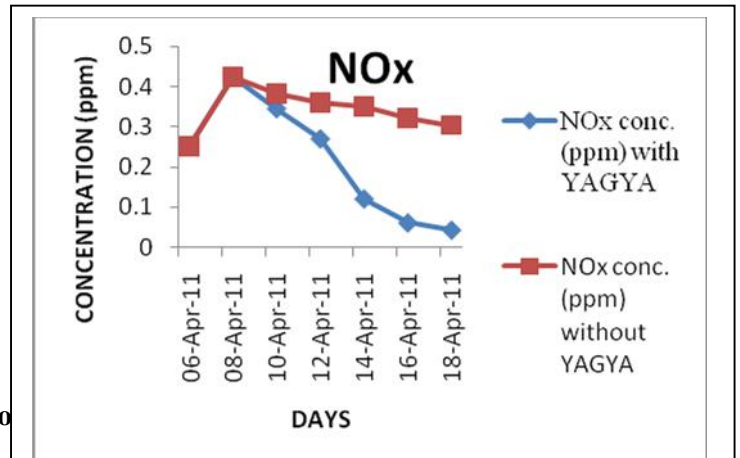
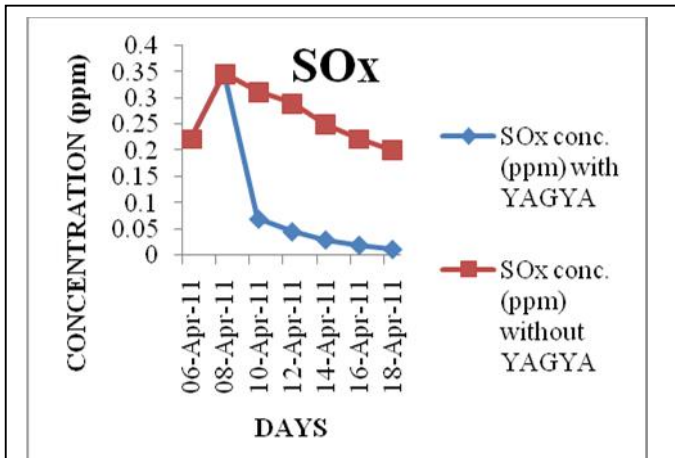
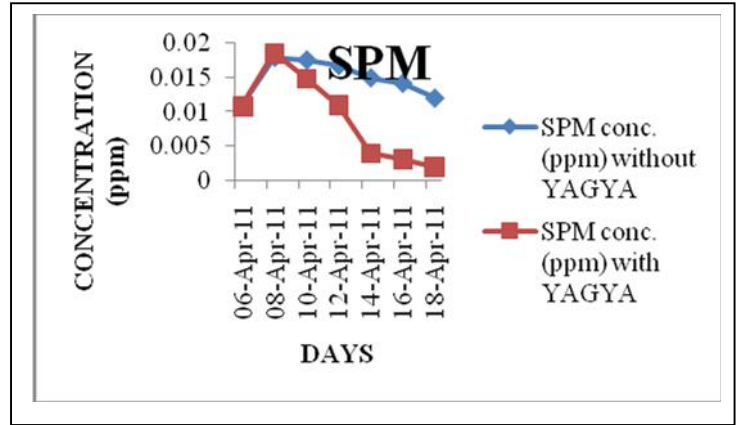
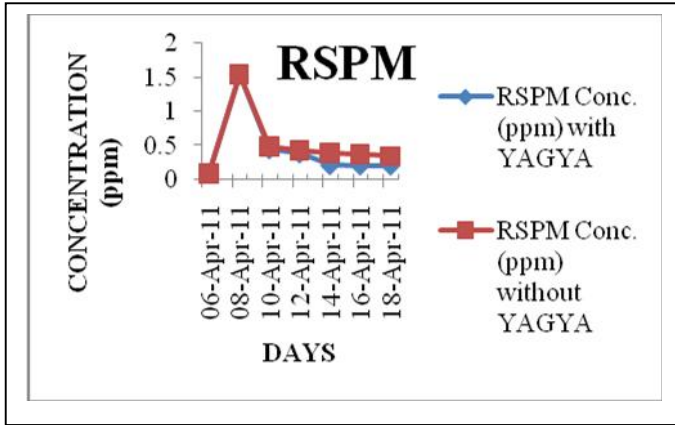



Table 4. Parameters temp, humidity, etc, during sampling

Date	Temperature in Celsius	Relative humidity in %	Sampling time	Timing	Sp. Humidity
6-apr-2011	24	17.5	14 hour	6pm to 8am	0.0045
8-apr-2011	26	30	14 hour	6pm to 8am	0.0092
10-apr-2011	25	19	14 hour	6pm to 8am	0.0052
12-apr-2011	30	40	14 hour	6pm to 8am	0.0106
14-apr-2011	28	36	14 hour	6pm to 8am	0.0101
16-apr-2011	29	34	14 hour	6pm to 8am	0.0096
18-apr-2011	30	30	14 hour	6pm to 8am	0.0092

Table no 5. Observation table for **RSPM** and **SPM.(with Yagya)**

RSPM				SPM		
Date	**Initial wt of paper (gm)**	**Final wt. of paper (gm)**	**Difference (gm)**	**Initial wt of paper (gm)**	**Final wt. of paper (gm)**	**Difference (gm)**
6-apr-2011	2.8690	2.9505	0.0815	10.2326	10.2435	0.0109
8-apr-2011	2.6938	4.2340	1.5402	10.2350	10.2536	0.0179
10-apr-2011	2.6945	3.1320	0.4375	10.2378	10.2527	0.0110
12-apr-2011	2.6528	3.0296	0.3768	10.2312	10.2422	0.0149
14-apr-2011	2.6965	2.9016	0.2051	10.2364	10.2404	0.0040
16-apr-2011	2.6233	2.8234	0.2001	10.2355	10.2387	0.0032
18-apr-2011	2.8532	3.0523	0.1991	10.2310	10.2330	.00020

Table no 6. Observation table for **RSPM** and **SPM.(without Yagya)**

RSPM				SPM		
Date	**Initial wt of paper (gm)**	**Final wt. of paper (gm)**	**Difference (gm)**	**Initial wt of paper (gm)**	**Final wt. of paper (gm)**	**Difference (gm)**
6-apr-2011	2.8690	2.9505	0.0815	10.2326	10.2435	0.0109
8-apr-2011	2.6938	4.2340	1.5402	10.2350	10.2537	0.0180
10-apr-2011	2.6940	3.1740	0.4800	10.2350	10.2526	0.0176
12-apr-2011	2.6932	3.1134	0.4202	10.2300	10.2468	0.0168
14-apr-2011	2.6820	3.0682	0.3862	10.2420	10.2570	0.0150
16-apr-2011	2.6832	3.0492	0.3660	10.2310	10.2452	0.0142
18-apr-2011	2.7502	3.0922	0.3420	10.2220	10.2320	0.0120

V. CONCLUSION

Under the natural lab conditions and after creating local and artificial indoor air pollution it was noticed that Sox, Nox were considerably reduced by almost 51%, 60%respectively more by yagya when compared without yagya and both RSPM & SPM were also found to be reduced by 9% & 65% more respectively as compared to the condition without yagya. Although the RSPM & SPM concentrations were still there but not to the extent of unhygienic conditions. The odor and smell of the Havan hall was not at all objectionable.

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